UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, PA 19103-2029

October 26, 2021

Sent via email

Mrs. Tiffani Doerr
Evergreen Resources Management Operations
2 Righter Parkway, Suite 200
Wilmington, DE 19803

Subject: Interim Measures Work Plan Response

Dear Mrs. Doerr:

The U.S. Environmental Protection Agency (EPA) has received and reviewed the Interim Measures (IM) Work Plan for the Marcus Hook Industrial Complex (MHIC) Area of Interest 7 (AOI 7) submitted by Evergreen on September 10, 2021. EPA hereby disapproves the IM Work Plan as it does not satisfy the following criteria from EPA's IM Scope of Work (https://www.epa.gov/sites/production/files/2016-03/documents/rcra_interimmeasurestta.pdf) as referenced in EPA's June 23, 2021 Request for Interim Measures Work Plan for AOI7:

- The work plan should provide a detailed schedule for proposing a specific IM and a timeframe for implementation once approved by EPA.

Additionally, EPA has section specific comments on the IM Work Plan which are attached to this letter as Attachment A.

EPA is requesting that within **45 days** of receipt of this letter, Evergreen submit a revised IM Work Plan for implementing IM at AOI 7 that addresses EPA's comments provided in this letter. Following the submittal of the IM Work Plan, EPA is requesting monthly check-ins to monitor progress.

If you would like to discuss this response or have questions, please contact me at 215-814-2796 or bilash.kevin@epa.gov.

Sincerely,

Bilash, Kevin
Digitally signed by Bilash, Kevin
Date: 2021.10.26 11:42:53 -04'00'

Kevin Bilash
Land, Chemicals & Redevelopment Division
U.S. Environmental Protection Agency, Region III

Attachment A

1. Section 1.2, page 2, next to last sentence of first full paragraph – The text states that the sluiceway discharges approximately 2500 feet down stream of Middle Creek. The discharge of the sluiceway to the Delaware River is actually approximately 900 feet downstream of where Middle Creek discharges to the Delaware River.

2. Section 2.2, SWMU 9/South Plant - Under the heading "2012 Development of PRGs", it is stated "The arsenic groundwater PRG was developed for the DVW site, by Honeywell, without the opportunity for Evergreen to review or comment, therefore the application of this arsenic groundwater PRG to AOI 7 is not appropriate until it is further evaluated for the AOI 7 Site." This statement is incorrect. The arsenic PRG is in no way specific to the DVW site, or any site. It is only specific to saltwater benthic organisms, and so is equally applicable to the tidal Delaware River offshore of AOI 7, or any portion of the River.

3. Section 3.1, page 15 – The text indicates a sheet pile bulkhead exists along a portion of the AOI 7 boundary with the Delaware River. Please indicate on a figure the location and extent of the sheet pile bulkhead. What is the depth of the sheet pile? Was the sheet pile placed before or after filling of AOI 7?

4. Section 3.4 Geology – The text on page 17 and Table 1 indicate that permanganate was seen in six newly installed well locations, and reference permanganate treatment conducted prior to the RFI at SWMU 23/24. However, all of the wells where permanganate was observed are distant from the SWMU 23/24 area and extend all the way to the southern boundary with the Delaware River. Was permanganate applied in other areas of AOI 7 as well? If not, what is the transport mechanism for permanganate to be distributed over such a wide area? If permanganate was applied in other areas in AOI 7, what was the reason, when did it occur, and is there a report documenting volumes of permanganate applied and how? What is the effect of permanganate on arsenic mobility or presence? An EPA guidance document related to ISCO using permanganate (EPA 510-B-17-003, page XIII-10) indicates that arsenic was often present as an impurity in permanganate: "Potassium permanganate is derived from mined potassium ores, which, by their nature, typically contain salt and metal impurities (e.g., arsenic, chromium, lead)."

5. Section 3.6.1 Tidal Influences in Middle Creek and Delaware River, Page 19 - The text states that Figure 9 elevations are relative to a local plant datum, not NAVD88. However, Figure 9 indicates elevations relative to MSL. Were both the well and river elevations relative to plant datum, or just the river?

6. Section 3.6.2 AOI 7 Hydrogeology – The text on page 19 states that Figure 3 shows remediation system wells for Middle Creek remediation system and also Phillips Island system. However, Figure 3 only highlights recovery wells associated with the Phillips Island system.

7. Section 3.6.2 AOI 7 Hydrogeology, Page 20, first paragraph – The text describes the presence of a wooden structure observed during the installation of MW-558D. Was the structure seen at ground surface, or was its presence assumed only by the presence of the wood pieces noted in the drilling log between 7 and 15 feet? Provide the field notes that describe how this feature obstructed well construction.

8. Section 3.6.2 AOI 7 Hydrogeology, Page 20, second and third paragraphs – The text states that shallow groundwater contours shown in Figures 11 and 12 indicate preferential pathways associated

with the 1953 location of Middle Creek shown in Figure 5. Figure 5 includes a dark blue line indicating the 1951 location of Middle Creek, but transferring that orientation onto Figures 11 and 12 does not show any relationship between the former orientation of Middle Creek and shallow or deep groundwater contours. Please identify the specific features within the shallow and deep contours the text is referring to. This section also describes localized mounding associated with water seepage from nearby fire water lines. The location and orientation of the firewater lines should be added to Figures 11 and 12, and if specific leakage locations are known, those should be highlighted. This water seepage may be responsible for all of the mounding seen in shallow and deep groundwater at AOI 7. Figures 11 and 12 indicate that wells MW-53, MW-565S, and MW-565D were not used in contouring because of fire line influence. Wells should not be excluded from contouring based on the source of water. Exclusion from contouring is acceptable if a well, because of construction or damage, is not representative of aquifer conditions, but in this case, the wells reflect the recharge from firewater leakage, which then spreads over the entire aquifer system. The data from these wells should be included in the contouring. Certain features of the contouring in Figures 11 and 12 indicate potential problems associated with well construction as documented in well boring and construction logs in Appendix D of the IM Work Plan as well as Appendix F of the June 7, 2017 AOI 7 RFI Report (see next comment below).

9. Appendix D, Soil Boring and Well Construction Logs (and Appendix F of the 2017 AOI 7 RFI Report) - The well construction logs of some of the deep wells indicate #1 filter sand rather than cement bentonite grout was placed above the bentonite seal from 0 to 15.5 feet (wells MW-536RD, MW-537RD, MW-565D, MW-606D, and MW-607D). Likewise, the well construction diagram for well MW-534L indicates 12.5 feet of sand placed above the bentonite seal. These wells must be abandoned and replaced with correctly installed wells. The annular space above the bentonite seal must be grouted. Having filter sand in the annular space above the seal creates a preferential pathway for shallow groundwater (which in AOI 7 has higher groundwater elevation) to impact deeper groundwater. This well construction may be responsible for some of the features seen in the shallow and deep groundwater contours (Figures 11 and 12). For example, the narrow trough in shallow groundwater at well MW-607S (i.e., the local depression in groundwater elevation at that location) may indicate drainage through well MW-607D (which appears to possibly be screened in the more permeable sand and gravel unit) causing the water elevation at MW-606S to be lower. The abnormally high groundwater elevations in wells MW-565D and MW-534L may be from preferential recharge through those wells' improper construction. Once the wells are abandoned and replaced, a new round of water elevation measurement and water quality sampling will need to be conducted, since the preferential flow from shallow to deep at these wells may have influenced water quality as well as water elevation. Other wells with improper construction as shown in the 2017 RFI include MW-533L and MW-530L. Several shallow wells installed for the 2017 RFI also indicate sand above the bentonite seal. All wells installed with sand above the bentonite seal must be reviewed with respect to water levels in shallow groundwater at those locations to see whether the improper construction creates any adverse effects.

10. Section 4.1 Sampling Rationale - The top paragraph on page 23 states that deep wells were installed, including the MW-560 location, but a deep well was not installed at that location. The text at page 25 (Section 4.3.1 Monitoring Well Installation) indicates the deep well to be paired with MW-560 could not be installed because the eroding shoreline of Middle Creek did not provide sufficient nor safe access for monitoring well installation. As data from that location appears to remain an important data gap, other options should be pursued to gain access to that location (from SWMU 9), or an

alternative location on SWMU 9 itself (i.e., immediately inside the SWMU fence between the existing MW-560 location and MW-124D). In addition, as the work plan indicated potential issues with comparing water quality in the sand and gravel versus the silty clay, a deeper well at the MW-560 location should also be installed to target the sand and gravel aquifer.

11. Sections 4.3.3 and 4.3.4 document the groundwater sampling for the two sampling events. Please provide field sampling forms for groundwater sampling events.

12. Section 5.2.4 Groundwater and Surface Water Elevations, Page 30 – The last sentence in this section states that Figure 12 shows a component of groundwater flow that is expected to go beneath Middle Creek. However, the water elevations in deep groundwater shown in Figure 12 do not support flow from SWMU 9 to AOI 7 under Middle Creek. All of the deep groundwater elevations in AOI 7 in the southwest corner have higher elevation than the deep elevations in SWMU 9. The observed deep groundwater elevations would suggest that water from AOI 7 flows under Middle Creek to SWMU 9. In addition, Figure 12 includes a single contour line on SWMU 9 based on groundwater elevation measurements at three wells: MW-123D, MW-124D, and MW-122. However, well MW-122 is screened in the fill material above the sand and gravel unit, and the other wells are screened in the sand and gravel unit, so these data should not be contoured together. As seen in Figure 7 (Cross-Section A-A'), the part of the aquifer screened at well MW-122 is equivalent to the screened interval at MW-560, so should be considered a shallow well and not contoured as a deep well. Table 2 also identifies well MW-122 as a deep well, but should be reclassified as a shallow well.

13. Section 5.2.5.7 Temperature in Groundwater - The top paragraph on page 34 indicates firewater line leakage as a potential cause for temperature elevation in certain groundwater wells (both shallow and deep). Provide a map showing the firewater lines and information on their construction, and provide any other evidence of their leakage. What is the source of the water in the fire water system? Is the river water intake (shown on figures in Appendix A), the source for water in the firewater line system?

14. Section 6.2, Modeled Arsenic in Groundwater, Page 38, bottom paragraph – The text states that most modeled concentrations were within the order of magnitude of the analytical results for dissolved arsenic in groundwater, with the exception of MW-509D, MW-537RS and MW-606D. Actually, the modeled arsenic concentration in MW-606D (94.4 mg/L) is within an order of magnitude of the detected concentration (730 mg/L).

15. Well 607D appears to be screened in the sand & gravel, and is significantly contaminated. The RFI excluded arsenic to the Delaware River water column as a pathway of concern, but the evaluation should be reconsidered once arsenic concentrations in the sand and gravel aquifer have been characterized. At a minimum, two sand and gravel wells installed along the front of AOI-7 should be proposed to evaluate groundwater quality discharging to DE River, as that unit is the most permeable, there is a downward gradient to that unit, and the current water quality discharging in the sand and gravel aquifer to the river is not known. Acceptable locations would be near MW-606D, MW-532L, MW-531L, and MW-530L.

16. New shallow wells MW-606S and MW-607S are contaminated with As at 35 mg/L and 24 mg/L, and represent the most contaminated shallow groundwater locations. All other shallow wells east of

Middle Creek are below cleanup levels. The possible sources to shallow groundwater at these locations should be explored.

17. Section 7.6, Potential Source Areas, Arsenic in AOI7 soils – This section states that "as discussed in Section 6.0 the modeling still cannot produce the high groundwater concentrations observed in the southwestern corner of AOI 7 based solely on the AOI 7 arsenic soil concentrations and observed geochemical conditions in that area." Appendix I calculations and Table 6.2.1 do not include the highest observed arsenic soil concentration of 11,000 mg/kg for modeling to fully support this claim. Evergreen should model and submit the result from sample location AOI7-BH-21-007. As there is not a correlated well and groundwater concentration, Evergreen can use an average of the available data in the area as discussed on Table I.1 of Appendix I for comparison.

18. Sections 7.8, Pathway Evaluation and 8.0, Conclusions and Recommendations - 9th Bullet - These sections appear to ignore the actual arsenic porewater concentrations obtained by the Army Corps of Engineers in 2019 in front of AOI 7. Theories regarding mass flux and supposed sequestration are irrelevant when all porewater results from the locations fronting AOI 7 exceeded the arsenic PRG, up to 9.6 mg/L.

19. Section 7.9, Risk Characterization
    a. This section introduces discussion regarding sediment DDx results in lower Middle Creek that exceed the DDx PRG. EPA requests removing references to DDx in the IM Work Plan as the focus and goal is to address Arsenic exceedances in groundwater discharging to the Delaware River.
    b. This section states "Based on the data utilized in the SLERA for the RFI, the Delaware River by AOI 7 is only slightly saline during low flows, and the benthos and fish are dominated by freshwater species." The AOI 7 SLERA based this comprehensive statement on one reference (Tyrawski, 1979), that was a single study conducted 42 years ago. This extremely dated, single study is unacceptable for drawing any conclusions, and is likely incorrect, just taking into account the ongoing effects of sea level rise on the Delaware River salt front. Using saltwater-based water quality criteria for tidal locations is common practice.
    c. This section then goes on to say ". . . but based on these considerations development of a PRG through an ecological risk assessment, similar to the process followed in the AOI 7 RFI is recommended to be discussed to be able to establish the appropriate remedial endpoint for an IM for arsenic in groundwater at AOI 7." First, PRGs are not developed in ecological risk assessments; they are calculated using EPA methodology from available toxicity studies. Secondly, the saltwater benthic organism PRG established to address porewater arsenic for the DVW Site is equally applicable to porewater offshore of AOI 7, see the comment above. EPA accepted and applied this PRG to the DVW Site, and will do the same for the AOI 7 Site.

20. Section 8.0, Conclusions and Recommendations – 10th and 11th Bullets

    a. The 10th bullet of this section ignores the actual arsenic porewater concentrations obtained by the Army Corps of Engineers in 2019 in front of AOI 7, all of which exceeded the arsenic PRG, up to 9.6 mg/L.
    b. The 11th bullet states "The arsenic in groundwater PRG developed for the DVM Site may not be appropriate for AOI 7 due to fact that it is based on a salt water endpoint, low flux from groundwater to porewater and limited exposure area for the benthos driving the PRG." This

statement is incorrect. As explained above, the saltwater endpoint is correct, the "low flux" is theoretical only and not supported by the actual data, and there is not a "limited exposure area for the benthos". Most benthic organisms are extremely limited in their horizontal movement, if anything, they vary more vertically than horizontally. If occurring in a contaminated sediment area, a typical benthic organism is likely to be exposed throughout much of their lifespan.

c. The 12th bullet includes "development of an alternative PRG for arsenic in groundwater for AOI 7 and/or completion of a SLERA for arsenic in groundwater." As discussed above, the arsenic PRG will be applied to AOI 7. Additionally, there is no need for a SLERA; the arsenic PRG was correctly derived using EPA methodology and accepted by EPA.

21. Section 9.0 Interim Measure – This section includes a potential approach for completing a two-stage pilot test to address arsenic in groundwater at AOI-7, and also states that Evergreen will consider what elements could be added to Honeywell's proposed cap (note that the proposed cap is not the responsibility of Honeywell alone, it is also the responsibility of Chemtrade). In any event, the pilot test is characterized as tasks that may or could be done, or batch scale column tests that could be completed. The workplan needs to propose the specific tasks that will be done, not what may or could be done. The second paragraph indicates that Appendix J shows the approximate location where slurry injections and monitoring could occur. Likewise, the third paragraph in this section states that the general area where pH adjustment via injection could occur is shown in Appendix J. However, Appendix J only lists potential interim measures under preliminary consideration, no figures are provided that indicate where pilot testing of any sort would be conducted. A proper workplan for the pilot testing should be provided, including a schedule for implementation. As the leaking fire water lines are impacting shallow and deep groundwater flow (and possibly contaminant distribution), the IM work plan should also propose activities to repair the leaking fire water lines.

22. Section 10, Proposed Investigation Activities – This section proposes groundwater flow measurements, sediment sampling, and porewater sampling. Evergreen must coordinate with EPA for the sediment sampling so that EPA (or its contractors) may collect splits for analysis. Additional and replacement monitoring wells should be installed as discussed in the above comments. Now that access to SWMU 9 wells has been acquired, sampling of the complete monitoring well network should be conducted (as originally proposed). A schedule for the investigation activities must be provided. Water elevation measurement should be conducted for the entire well network after new and replacement wells are installed. If not done already, the staff gauge for the Delaware River should be surveyed to NAVD88 (the work plan had specifically indicated that Delaware River tidal study water elevation measurements were relative to a plant datum, not NAVD88). Surface water elevation at staff gauges in Middle Creek and the Delaware River should be collected continually over a tidal cycle. The two staff gauges installed by Honeywell should be utilized as well as the two staff gauges installed by Evergreen.

23. Section 10.2, Sediment Sampling and Figure 32

    a. The proposed sediment sampling methodology in this section, including selective sequential extraction, is the same research-style investigation previously done by Anchor QEA for Honeywell. This research was not requested by EPA. Most importantly, this expensive study had absolutely no effect on the remedial strategy, which consists of a cap to eliminate aquatic exposure to sediment pesticides and metals, with an amendment layer to capture soluble

arsenic. Furthermore, the proposed study results are not useful to EPA as they cannot be compared to other grab sample results.

b. Revise to re-locate all nine proposed sediment samples to adjacent to the AOI 7 shoreline, at the foot of the riprap where soft sediment first occurs. A petite Ponar dredge or similar equipment may be used to obtain nine grab samples to be analyzed for arsenic to compare to the 170 mg/kg PRG.

24. Section 10.3, Pore Water Sampling and Figure 32

    a. The proposed pore water sampling methodology in this section is again using a non-standardized research-style technique, which cannot be directly compared to other pore water results for the DVW project. The peeper equipment and technique is so investigative that there is not even a standardized equilibrium period, with researchers using periods ranging from a single day to well over a month. These results will not be accepted by EPA.
    b. Revise to re-locate the pore water sampling locations to match the nine sediment sample locations, adjacent to the AOI 7 shoreline, at the foot of the riprap where soft sediment first occurs. Revise to use the sample collection technique provided in the U.S. Army Corps of Engineers DVW Pore Water Sampling Event Report dated January 2019, which in most cases was successful.
    c. Without this preliminary data, it is premature to collect delineation pore water samples further out in the river as shown on Figure 32. Additionally, any necessary step-out samples would be collected on a smaller grid.

25. Table 2 – This table provided a summary of groundwater elevation measurements. Several wells indicate different top of casing elevations for different measurement dates, with a resulting significant difference in levels presented in the corrected groundwater elevation column, even though measured depths to water were similar. Wells with changes in top of casing elevations between measurement dates include: MW-48, MW-53, MW-56, MW-187, and MW-558. Only the TOC change for MW-558 is explained in the footnote. Why did the other TOC measurements change?

26. Table 7 - The results presented in Table7 indicate a start and end depth for the sample location indicating 5-foot intervals were collected below beginning at 10 feet. However, the depth intervals don't match what is shown on the boring logs. The boring logs indicate samples were collected from 4-foot macro-core samplers. For example, the boring log for AOI 7-BH-21-007 indicates three samples were collected from 20 to 30 feet (20-24', 24-28', and 28-30') but Table 7 indicates two samples for that interval (20-25' and 25-30'). Please explain.

27. Figure 7, Cross-section A-A' – This section should include shallow water elevation for MW-124S. The water elevation shown for Middle Creek was based on measurement at mid to high tide. The elevation range (tidal range) should be shown instead.

28. Figure 8, Cross-section B-B' – This section should be extended into the Delaware River to show the relationship of groundwater flow to surface water. The section should be extended far enough to show the Delaware River channel morphology all the way to the dredged navigation channel. Additional cross-sections should be drawn to provide a more complete picture of certain conditions. For example, well MW-607D appears it may be screened in the sand and gravel aquifer below the silty clay, unlike all other AOI 7 deep wells. Location and depth of firewater lines should be shown, including where leaks are known or suspected. Sections should also show arsenic soil concentrations

with depth where collected. Sections should show any feature that may impact groundwater flow (e.g., bulkheads).